Testboy®
GmbH, Germany
Stands For Quality
Since 1953

UNCOOLED FPA Infrared

Thermal Imaging Camera

TV304

Operator's manual

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Warnings & Cautions

- The infrared camera is a precision instrument and uses a very sensitive IR detector. Pointing the camera towards highly intensive energy sources-such as sun or devices emitting laser radiation or reflections from such devices-may affect the accuracy of the camera, or even harm-or irreparably damage-to the detector, whether the power supply of the camera is switch on or off.

- Avoid incorrect operation methods such as heavy pressing, shock or strong vibration during the course of transportation, store and installation, otherwise the product could be damaged.

- For protective reason please keep the product in the environment between -25°C and +60°C during the course of transportation and store. Original packaging box should be used during transportation.

- For protective reason the camera should be stored in shady, dry and draughty environment avoids electromagnetic interference.

- Avoid contaminating and damaging the lens surface by oil stain or chemicals. Cover the lens cap after use.

- Backup is recommended to avoid latent loss of data. Please copy (back up) the data regularly.

- Please take out the battery if the camera out of use for a long time, otherwise the product could be damaged.

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1 Introduction

Thank you for choosing the TV304 infrared thermal imaging camera.

The TV304 is a small and light handheld thermal imaging camera. It uses advanced uncooled microbolometer. The camera is designed for variety applications including electrical predictive maintenance, security, medical thermography, rescue and so on. The camera is very easy to use and is operated by using a few buttons which are conveniently placed on the camera.

The compact design offers advanced features such as finger-tip controls, high quality thermal images, on-board image processing, large capacity memory and versatile USB connectivity.

TV304 camera can be used as

- ✧ **Power Supply:** Thermal condition checking, fault & defect diagnosis on transmission lines and power equipment.
- ✧ **Petrol-Chemical:** Inspection of oil pipeline, detection of material surfaces, heat spilling, as well as on heat-preservation structure, power equipment, etc.
- ✧ **Fire fighting:** Forest-fire prevention, searching for latent source of ignition, preventive detection on specific material auto-ignition, and safety detection on electrical device for fire-prevention.
- ✧ **Medical treatment:** Body temperature measurement and analysis of temperature distribution.
- ✧ **Others:** Multiple-purpose for railway industry, construction industry, scientific research, etc.

2 Technical Specifications

Table 2.1 Technical Specifications

Image Performance	Detector Type	Focal Plane Array (FPA), uncooled microbolometer
	Resolution	384×288
	Thermal Sensitivity	0.06℃ @30℃
	Field of View/ Min Focus Distance	16°×12°/0.5m
	Focusing Method	Manual
	Spatial Resolution	0.88 mrad
Image display	LCD display	Built-in High resolution color 2.8"LCD
Measurement	Temperature range	- 20℃~500℃
	Accuracy	±2℃ or ±2% of reading whichever is greater
	movable spot	4
	Movable area	3
	Line profile	√
	Max and Min temperature for areas	√
	Average temperature for areas	√
	Isotherms	√
	Temperature Difference	√
	Alarm(voice, color)	√
	Palette	11 palettes changeable
Image storage	Image storage	1000 images
	File format	JPEG;14 bit thermal measurement data included
	Voice annotation	40 seconds voice record along with every image
Laser Pointer		Class 2, 1mW/635nm (red)
Power	Battery type	Li-Ion, rechargeable
	Battery operating time	3 hours continues
	Power saving	√
Environmental characteristics	Operating temperature	- 15℃~+50℃
	Storage temperature	- 25℃~+60℃

	humidity	Operating and storage：≦90% non-condensing
Physical characteristics	Weight	0.91 kilogram
	Dimension	310×127×90mm
Interface	Power input	√
	Audio output	√
	Video output	PAL/NTSC Output impedance 75ohm
	USB	√
	SD Card	SD Card(1G)

3 Peripherals

3.1 Standard Peripherals

TV304 infrared camera and its accessories are delivered in a hard transport case. The system comprises:：

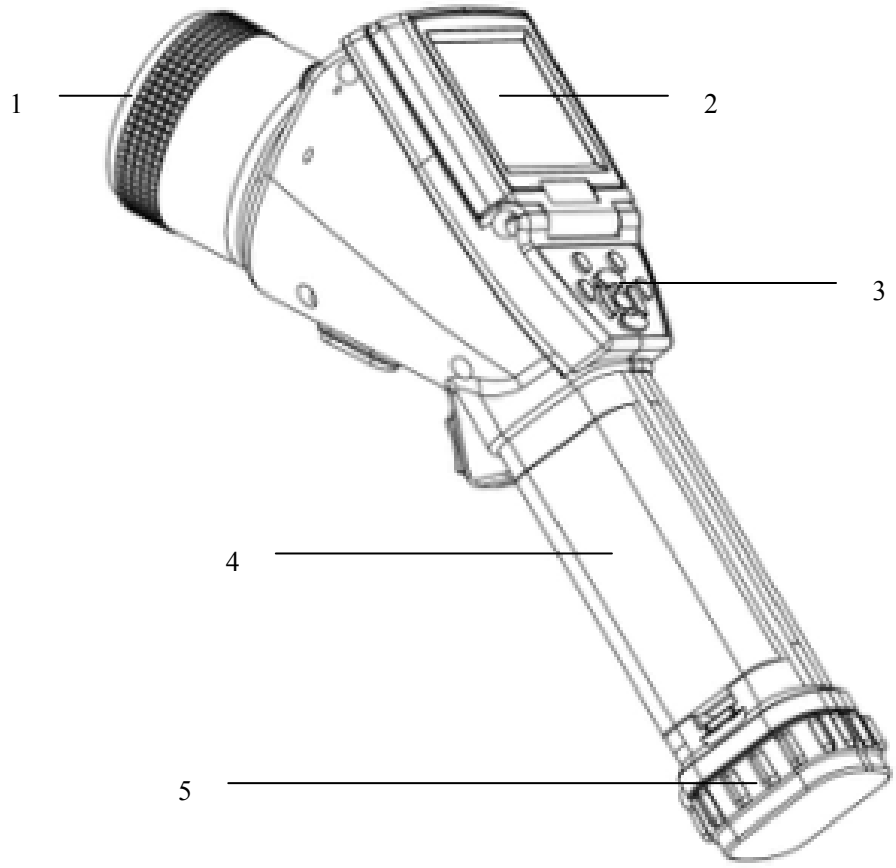
- TV304 infrared camera
- USB cable
- Transport case
- User's manual
- Two SAMSUNG L160 lithium batteries
- Battery charger
- Lens cap
- Audio adaptor cable
- Video cable
- Browse software
- Earphone

3.2 Optional Accessories

Optional accessories include:

- 75mmlens
- Analyzing software

4 Appearance



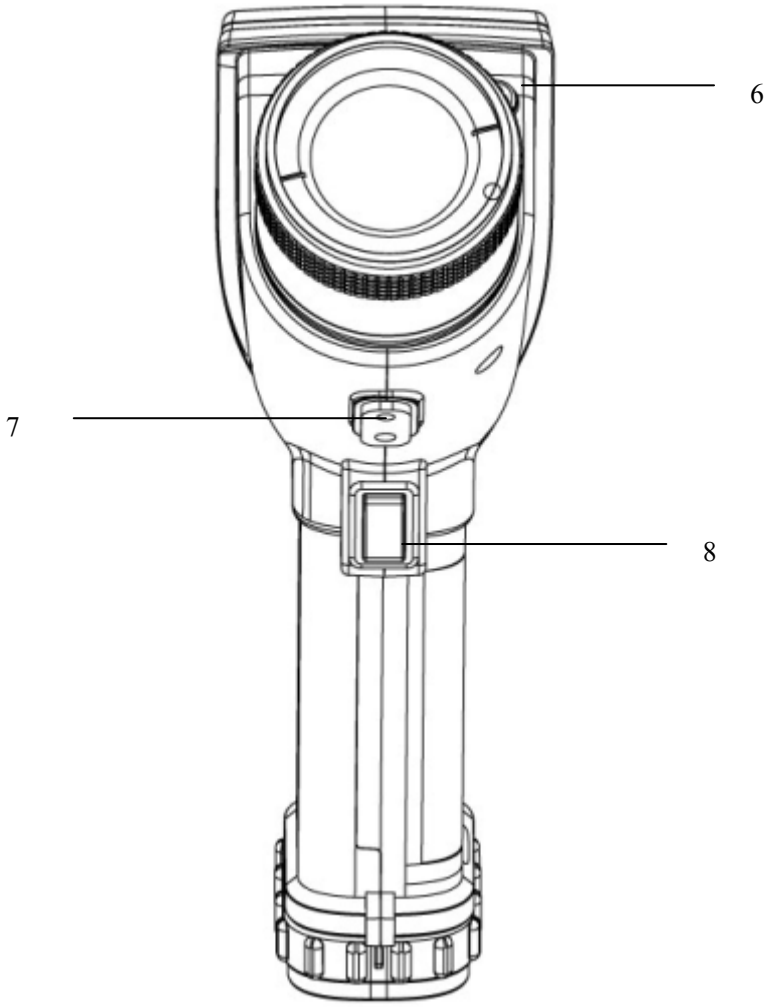


Figure 4.1 TV304 camera appearance

Table 4.1 Appearance

Number	Description
①	Lens, manually focusing
②	Tripod fix point LCD display
③	Keyboard , it will be described in chapter 6
④	Battery position
⑤	Output interface cover
⑥	Laser indicator
⑦	Tripod mounting point
⑧	Shortcut trigger User-defined function，default setting is laser indicator

5 Interface

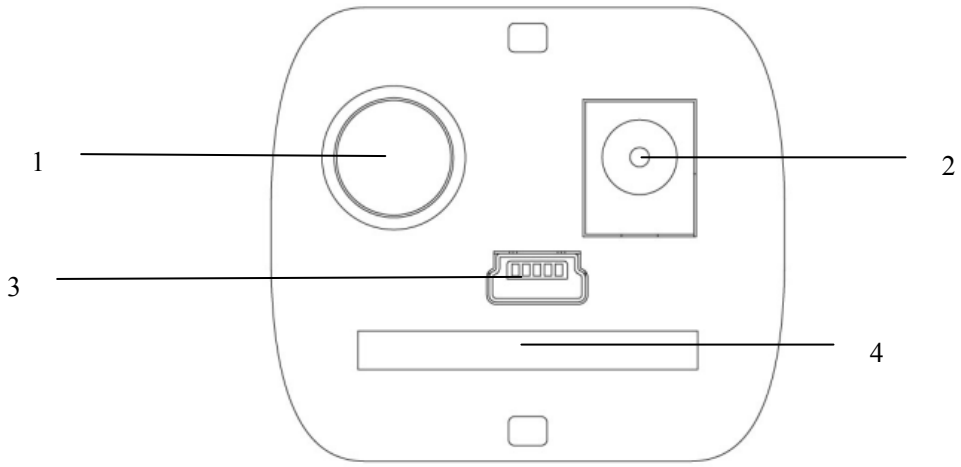


Figure 5.1 Interface

Table 5.1 Interface Description

Number	Description
①	S type connector. For connecting video cable and audio cable.
②	External power connector
③	USB interface For the thermal imager and computer data transmission.
④	SD card slot

Note: The USB connector will show the images in the internal FLASH by default, please use SD card reader to browse the saved images in SD card.

6 keyboard description

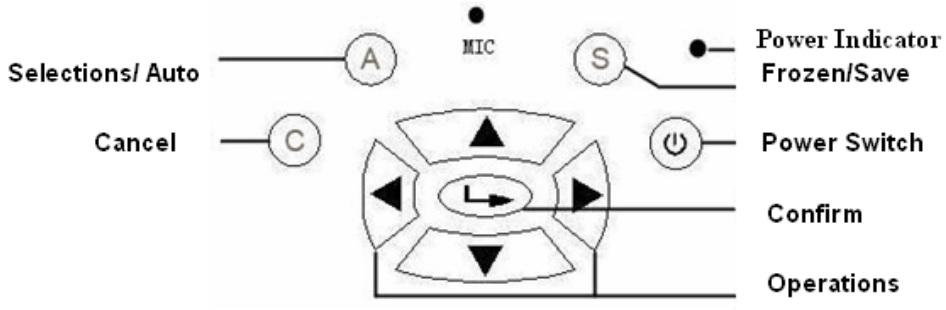


Figure 6.1 Keyboard

Table 6.1 Keyboard Description

Name	Description
Selections/ Auto	■ Hold this for three seconds to get the best image automatically. ■ Press this to set the emissivity, measurement method and palette alternately.
Cancel	■ Cancel the current operation. ■ Exit a menu, dialog box, or a prompt window. ■ Return to the real-time measurement mode.
Directions /Confirm	■ Press Confirm to show the pull up menu. ■ Press Confirm to save the changes and exit. ■ Press direction buttons to change the menu. ■ Press direction buttons to move the spot position. ■ If palette is chosen，press left/right button to change ■ If the imager is in manual adjustment condition, press up/down button to change the temperature limit of the palette.
Power Switch	■ Hold this button for three seconds to switch on/off the power.
Frozen/Save key	■ Press the button to freeze the image. ■ Press again to save the frozen image. ■ Hold the button to save a live image.
Power indicator	■ Indicate the imager´s operating state

7 Tutorials

7.1 Battery Operation

7.1.1 Load the battery

The battery compartment is located in the handle of the unit.
To open the battery compartment just simply hold the release trigger, and take it out.

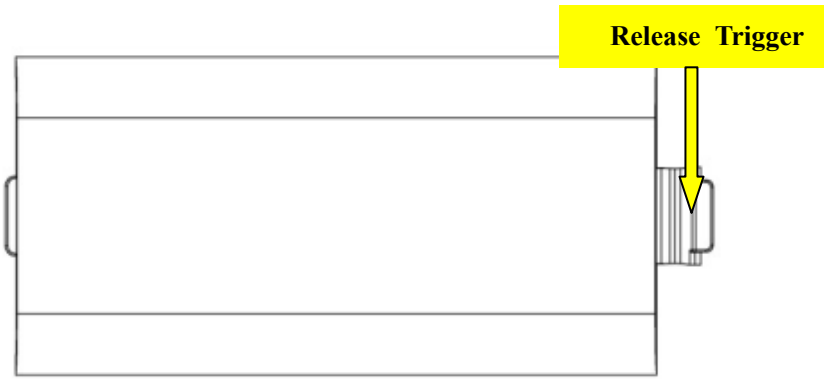


Figure 7.1.1.1 Position of Release Trigger

Put the battery in the battery box with the connectors facing to each other. Then keep it steadily flat. The connectors are shown by the arrows below.

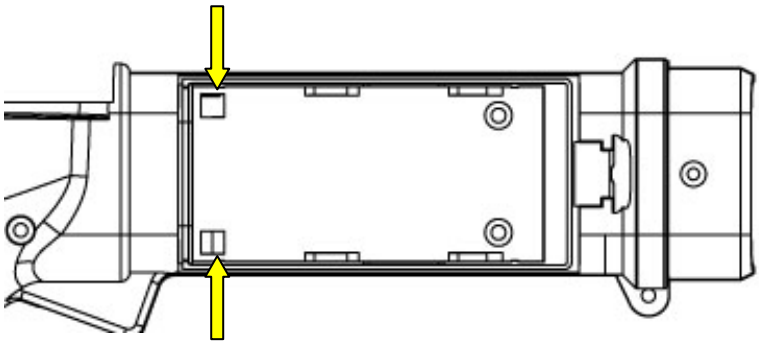


Figure 7.1.1.2 Position of connectors

Then put the battery in the compartment, hold and push it forward，until it is optically charged.

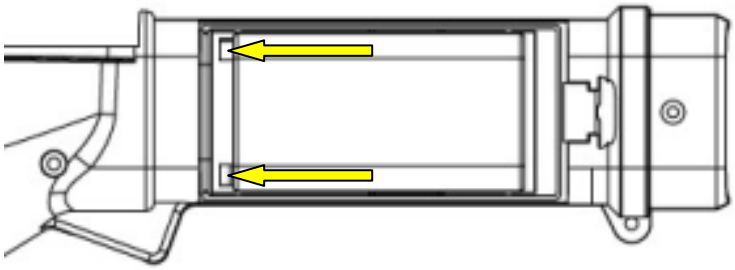
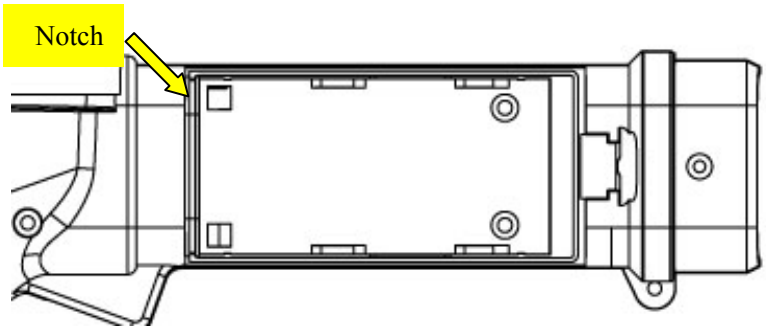


Figure 7.1.1.3 direction of charging the battery

To replace the battery cover back just insert the forward part of cover to the notch， and press the backwards to lock the release trigger.



7.1.2 Unload the battery

To unload the battery, just take off the cover by pressing the release trigger.

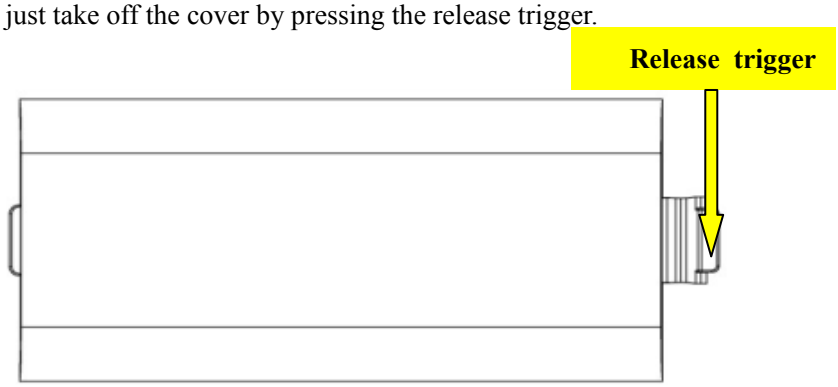


Figure 7.1.2.1 Position of the release trigger

Then hold the battery and pull it backward to take it out.

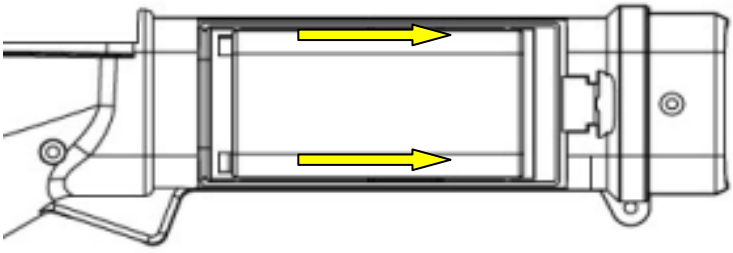


Figure 7.1.2.2 Direction of unload the battery

Put the cover to the box and push down the cover buckle to finish the unloading operation.

7.2 Quick Operation

7.2.1 Capture an image

Please follow the steps below to capture an infrared image:

step	Operation
1	Put the battery in the compartment.
2	Hold the ON/OFF power button to switch on the camera. Then wait for a few seconds to let the machine start up.
3	Point the camera to a warm object. You can press and hold the 'F' trigger to turn on the laser indicator to exactly locate the target.
4	Adjust the lens ring clockwise or anticlockwise to obtain the best display.
5	Move the target object to the center of the screen, if the target becomes unclear, adjust the lens ring again to get the best focus.
6	Press and hold down the 'A' button to calibrate the focus automatically.
7	If different position is needed to measure, just press 'S' button to freeze the image, and press 'A' button to select the point, and then move the point to the position of the target.
8	If multiple points need to be measured, or even areas need to be measured, press to call the main menu function. Choose 'Measurement' to add points, profile and areas to the screen, but there are 4 points, 1 horizontal or vertical profile, and 3 areas can be added at most. Details can be consulted in chapter 8.

Note: When the temperature of the target object is higher or lower than the value of corresponding camera temperature range, the temperature value shown on the screen will be in the form of <XXX°C or >XXX°C.

7.2.2 Color and scale

In some occasions, you may find out that the images you have captured do not appear satisfying.
You can change the color palette prior to saving the image and can change the palette of the image.
There are eleven different Palette scales available.
To switch between the palettes, you just need to press 'A' button continually to choose the scale until the scale is shown in yellow frame. Then press ◀left, ▶right button to switch between the palettes.

Note: you need to press 'A' *button several times to go to the palette change function. The scale will be framed in yellow, but not the temperature value, the temperature value framed in yellow is used for adjusting the level and span manually.*

7.2.3 Saving an image

There are four ways to save the current thermal image:

Methods	Operation
1	If an image has been frozen, press 'S' button again to save the frozen image.
2	If an image has been frozen, press the Confirm button(the middle button of the joystick) to show the pull up menu, select "File", and "Save" to save the image to the memory.
3	If the unit is in live mode, hold 'S' button for three seconds to save the current live image.
4	Set the shortcut trigger to "Save", then press the shortcut trigger to save the image.

7.2.4 Opening an image

Please follow the descriptions below to open an image

Steps	Operation
1	Press Confirm button to activate the main menu，choose "File" and then "Open" to show the saved images. The images' name will be shown as IR_XX(position of the current image/total images) on the left top corner.
2	Move the joystick left or right to change the current displaying image.
3	Press ○,Cbutton to exit the operation, and back to the measuring mode.

7.2.5 Transmit an image

The imager can be connected to a computer by the attached USB cable. Use the given software to analysis or manage the images.

Note: Please use the imager's own function to format the FLASH memory. The format operation on the computer is not recommended.

8 Operation guide

8.1 Screen objects

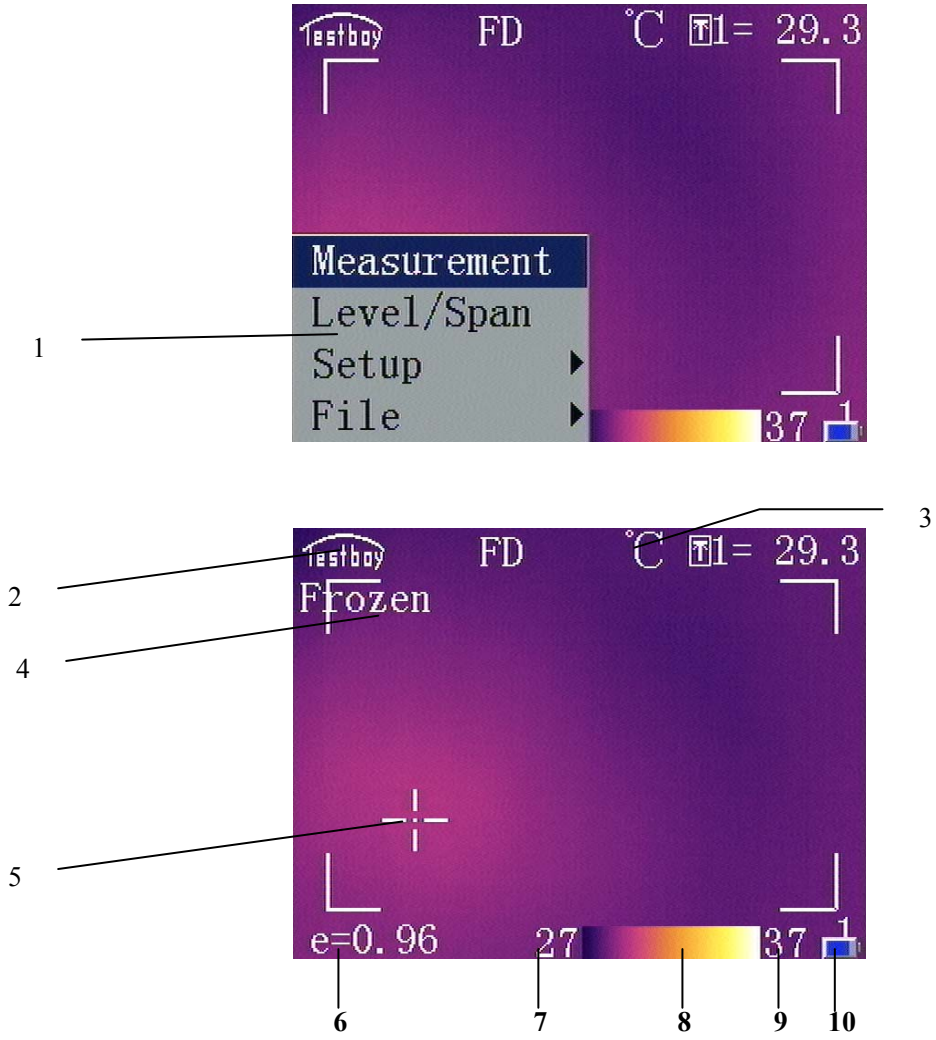


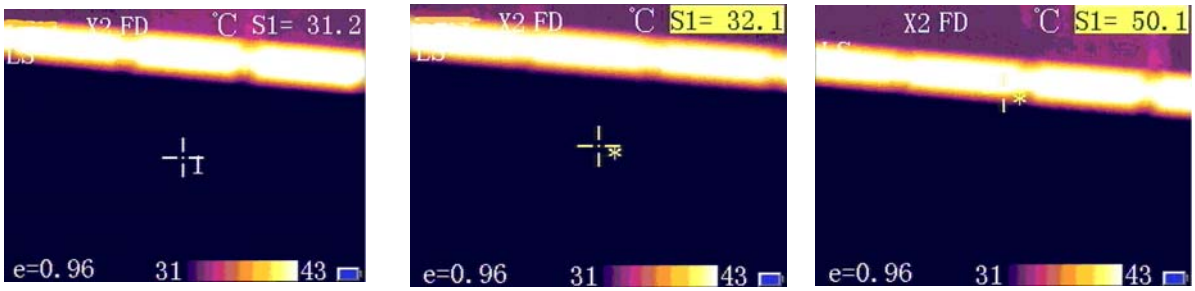
Figure 8.1 Screen Objects

Table 8.1 Screen Objects

Number	Name	Description
1	Pull up menu	To display the system management menu
2	TESTBOY logo	To display the logo of TESTBOY
3	Result table	To show the value of spot measurement result
4	Status message	To display the status of system, like 'Frozen' or 'LS'
5	Spot position	Temperature measurement mode, which appears as a cross cursor.
6	Emissivity	To indicate the current value of object emissivity
7	Lower temperature limit value	To indicate the underflow temperature on the color scale

8	Temperature scale	To show the scale of the thermal image
9	Upper temperature limit value	To indicate the upper flow temperature on the color scale
10	Battery level	To indicate the battery status

8.1.1 Moving Temperature spot



Live measuring mode Measuring point 1 Measuring point 2

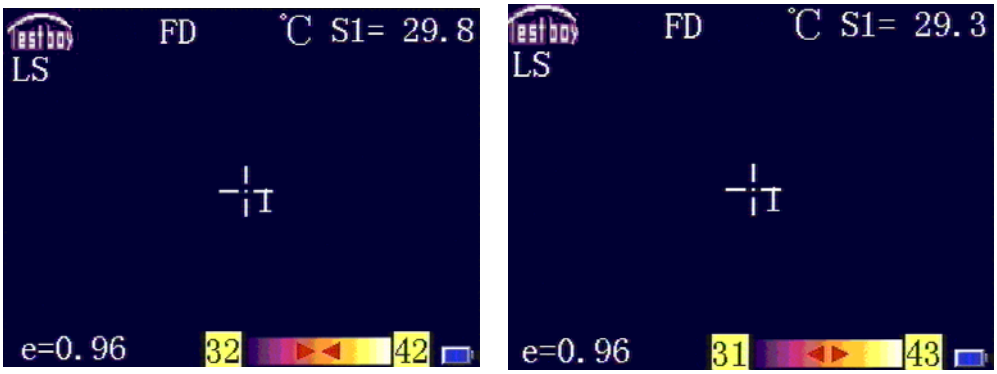
Figure 8.1.2 Moving a spot

1 In the live measuring mode, press'A' button to choose the measuring point, then the cross cursor and the measured temperature will be shown in yellow, at the same time, the suffix mark of the cross cursor "1" will be changed to "*".

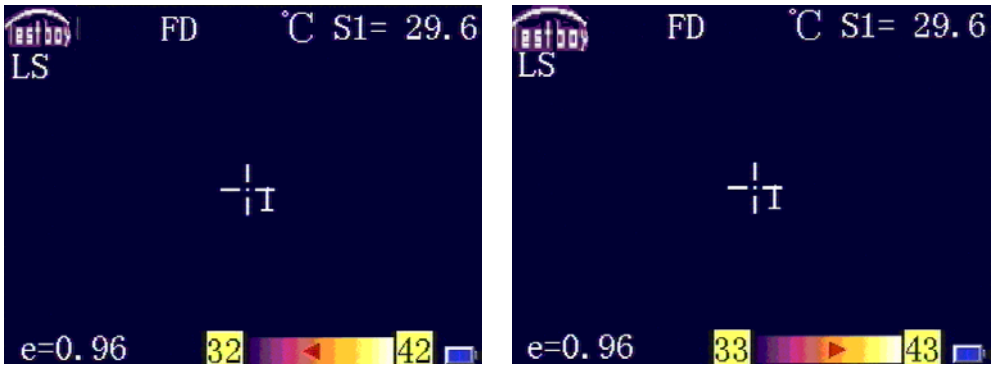
2 when the measuring spot has been chosen, use ▲up, ▼down, ◀left, ▶right button to move the spot, and the temperature of different position will be shown up on the right top corner at the same time.

***Note**: press* 'A' *button to select the point measurement, palette, manual/auto, or emissivity alternately.*

8.1.2 Level and Span



(A)decrease the temperature span (B)increase the temperature span



(C)decrease the measuring level (D)increase the measuring level

Figure 8.1.4 Level and Span

1. Press 'A' button to choose the scale and enter the manual adjustment. Then the limit temperature will be shown in yellow and the screen will display "LS" on the left top corner.
2. When the scale is under current operation, press ◀ left button to decrease the temperature span, shown as Figure 8.1.4（A）.
3. When the scale is under current operation, press ▶ right button to increase the temperature span, shown as Figure 8.1.4（B）.
4. When the scale is under current operation, press ▼ down button to decrease the temperature level, shown as Figure 8.1.4（C）.
5. When the scale is under current operation, press ▲ up button to increase the temperature level, shown as Figure 8.1.4（D）.
6. When the scale is under current operation, press 'C' button to exit the manual operation.

8.2 Menu functions

The menu system is including four main groups Measurement, Level/Span, File and Setup. This section describes all menu functions in details.

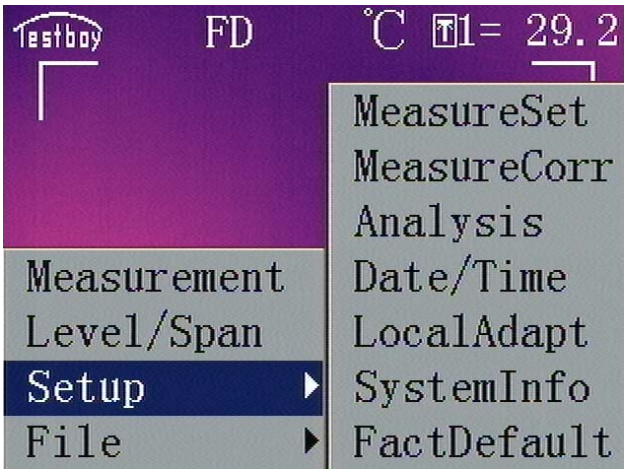


Figure 8.2.1 Main Menu

8.2.1 Measurement

This function is used to add or delete object measurement. Choose and confirm will show the following dialogue box.

This function contains command of '**Add Spot', 'Horizontal Line', 'Vertical Line', 'Add Area',** and **'None'**. There are at most four points, one profile, and three areas can be added at the same time.
If choose **'None'**, then press confirm button, it will delete all the measurements.
To delete a single object measurement, user can press "A" button to activate it, and then press C button to delete it.

8.2.2 Level/Span

This function is used to activate the level and span function; It is the same function as which is mentioned before in chapter 8.1.3.

Choose this function to go to the Level/Span function directly, instead of continually pressing ○,A button.

Use direction keys to adjust the value.

8.2.3 Setup menu

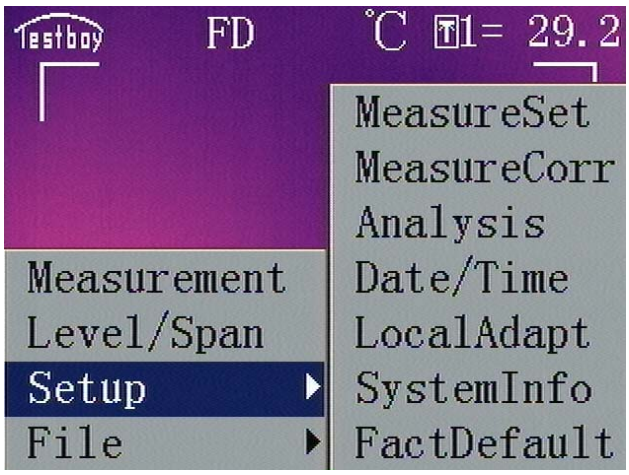


Figure 8.2.2 Submenu of Setup

8.2.3.1 MeasureSet

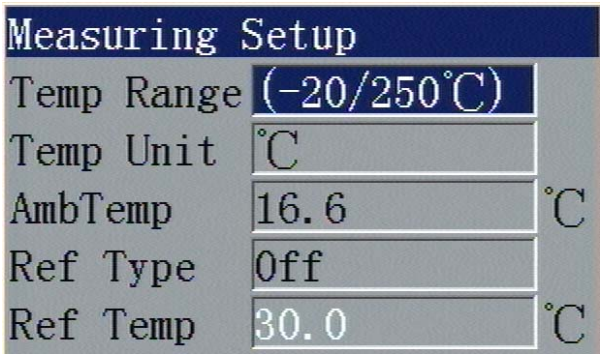


Figure 8.2.2.1 Measuring Setup

Temperature range： Display temperature range of the camera. If the measured temperature exceeds the range, the accuracy of the measurement can't be ensured.

Temperature unit: there are three temperature units: °C, F, K to suit different situations.

Ambient Temperature: when the system starts, it will check the environment temperature once. Also it can be adjusted manually.

Reference temperature measurement: user can turn on, or turn off the reference temperature measurement. When it is on, the temperature results shown on the screen are all the differences between the object's temperature and the reference temperature.

Reference temperature: Effective only when reference temperature measurement is on. Can choose a constant temperature as the reference temperature, and also can choose an object's temperature as reference temperature.

8.2.3.2 MeasureCorr

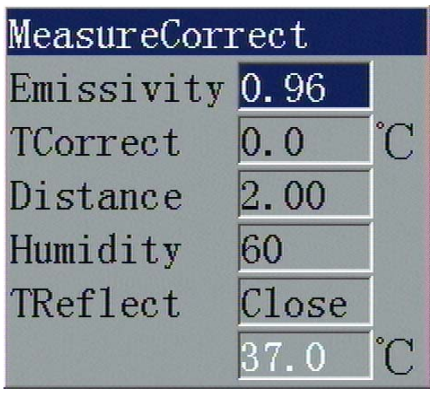


Figure 8.2.3.2 Measuring Correct

Emissivity： To set the emissivity, press left or right key to adjust.

TCorrect： To setup system's temperature correction.（normally set by manufacturer）

Distance: The distance between the machine and objects. Need to be set manually. (It is better to use the actual distance within 10 meters, and farther than 0.5 meter)

Humidity: Current environment relative humidity.

TReflect： To setup the system's reflecting temperature.（normally set by manufacturer）

8.2.3.3 Analysis

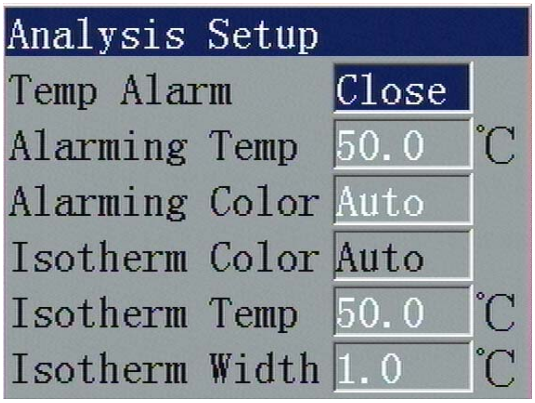


Figure 8.2.3.3 Analysis Setup

Temp alarm: To turn on or off the temperature alarm. It is only efficient when doing area temperature measurement. When it is turned on, and if the temperature is in the alarming temperature area, the buzzer will automatically run and the region will be shown as the alarming color. The alarm color can be set at 'alarming color' column.

Alarming Temp: set an alarm temperature. This function is only efficient when temperature alarm is on.

Alarming Color: there are 9 colors to choose. When choose 'auto' it will not change the original color of the screen.

Isothermal color: same as alarming color.

Isothermal temperature: the temperature of the isothermal central point.

Isothermal width: The value of a symmetry region around the central isothermal point. If the isothermal temperature is 50°C, isothermal width is 2°C, then the isothermal range will be 49°C ~ 51°C.

8.2.3.4 Date & Time

Figure 8.2.3.4 Date/Time dialog box

Set date and time, via submenu, when the Date & Time dialog box is displayed on the screen. Use the up/down button to select an item. Use the left/right button to change an item value. The parameter item will be automatically saved by the system. Item selected will be highlighted in blue.

Note: Need to reset the time and date when not in use for a long time, as internal battery's power is limited.

8.2.3.5 Local Adapt Setup

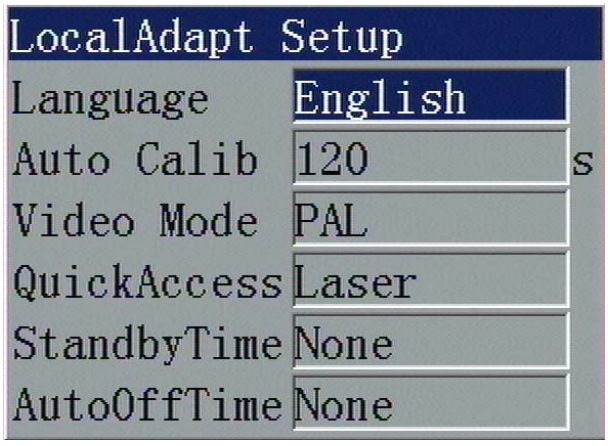


Figure 8.2.3.5 LocalAdapt Setup dialog box

■Point to the **Local Adapt** and press the confirm button to display the **Local Adapt Setup** dialog box.

Language: There are two languages can be changed: English and Chinese.

Auto Calib: Auto calibration time. Press left and right key to adjust. Short press will change the value by 1, and deep press will change the value by 10.

Video Mode: There are two video mode can be chosen, PAL or NTSC.

Quick Access: Define the function of the shortcut key

- ✧ Set as 'laser pointer', press shortcut key to turn on or turn off the laser pointer.
- ✧ Set as 'spot measurement', press shortcut key to add or delete a spot.
- ✧ Set as 'select color scale', press shortcut key to a select color scale.
- ✧ Set as **'**save', press shortcut key to save an image.

Stand by Time: Navigate the integration button to specify the time after which the display will be switched off if it is not used. Choose 'None' to switch off this function.

Auto Off Time: Navigate the integration button to specify the time after which the camera will be turn off if it is not used. Choose 'None' to switch off this function.

Note: *The camera program will be restarted when you change the language. This will take a few seconds.*

8.2.3.6 System information

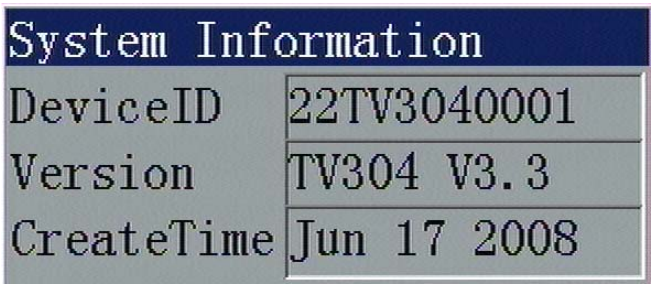


Figure 8.2.3.6 System Information dialog box

This is to display the device information: the device ID number; version of operation system and time of manufacture will be shown on the screen.

8.2.3.7 Factory Default

Figure 8.2.3.7 Reset of Factory Default

Restore the factory default setup. When the Restore default dialog box displayed on the screen, press the Central Confirm button to restore, and press C button to quit.

Note: *This function will remove all the settings made by user. The camera will be restarted when you restore factory settings. This will take a few seconds.*

Factory setting parameter table

Parameter	Value
Emissivity	0.96
Color scale	On
Data field	On
Language	ENGLISH
Temp Unit	℃
Shortcut key	laser pointer
Screen Turn off time	None
Battery turn off time	None

8.2.4 File menu

The file menu contains all the functions dealing with the digital image, with four submenus of **Open, Save, Delete** and **Format**.

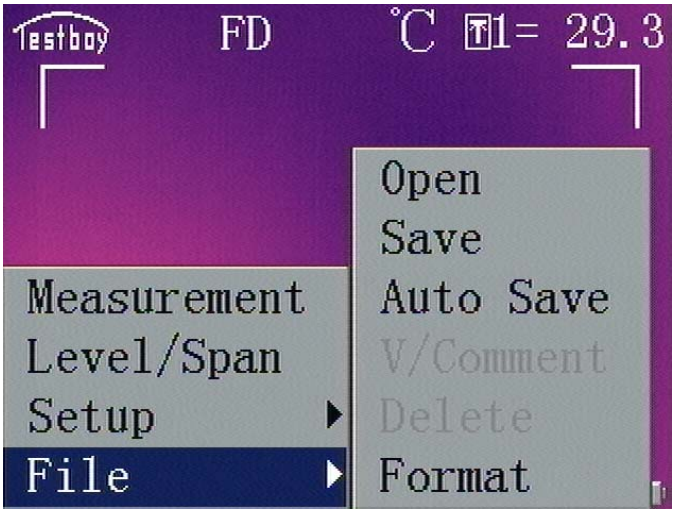


Figure 8.2.2 Submenu of File

8.2.4.1 Open

This function is used to open saved images form built-in flash. The function brings up the saved image on the screen directly.

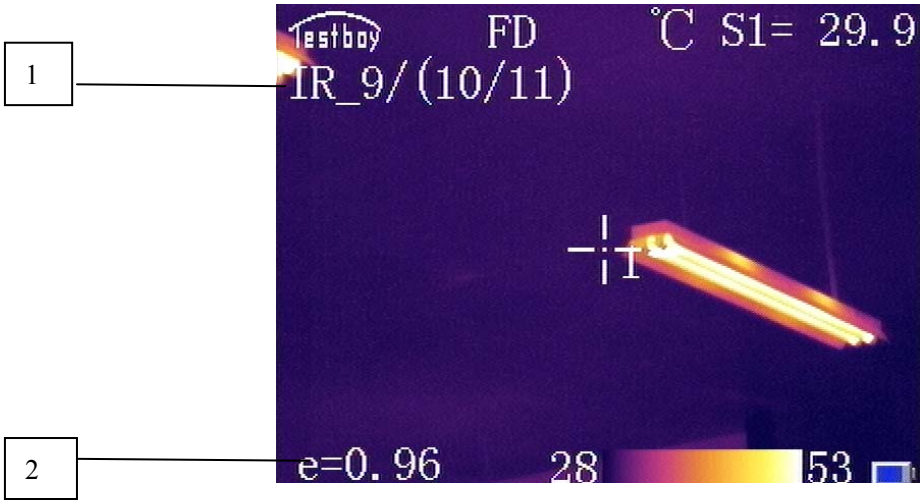


Figure 8.2.1.1 information of saved image

[1] File number: Display the opened image information (file number/total images been saved)

[2]. **Emissivity:** Display emissivity of the opened image.

Press the "C" button to go to live mode.

8.2.4.2 Save

Point to **Save** and press confirm button to save the displayed image to the internal flash memory or the compact Flash card.

Figure 8.2.1.2 Saving an image

8.2.4.3 Delete

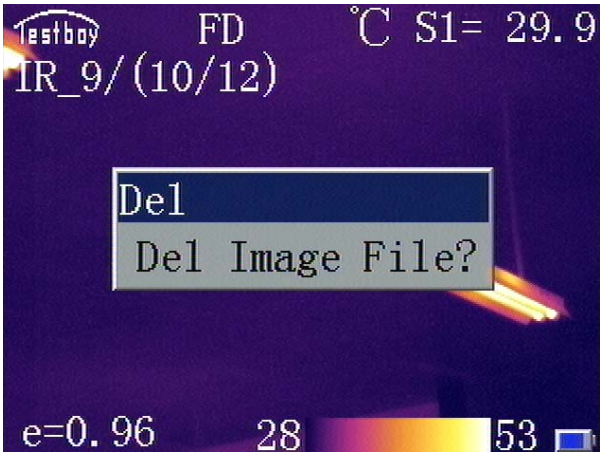


Figure 8.2.1.3 Deleting an image

- Point to **Delete** and press the confirm button to display **Del** dialog box. Press confirm button to delete the opened image.
- Press the confirm button or C button to delete the image or not.

8.2.4.4 Format

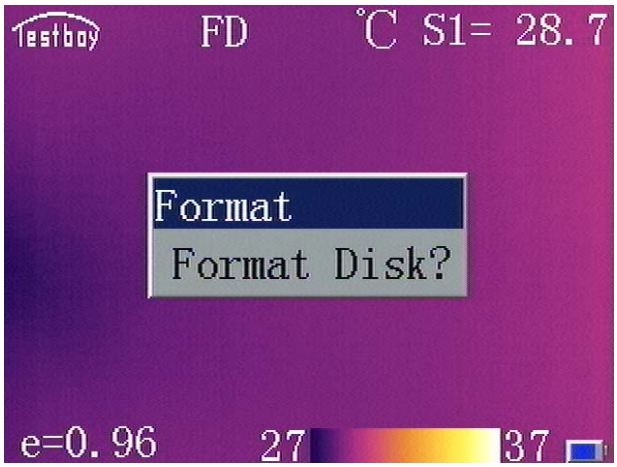


Figure8.2.1.4 Format the Disk

- Point to **Format** and press the confirm button to display the **Format** dialog box.
- Press the confirm button or C button to format the Flash card or not.
-

Note: This function will delete all data on the FLASH card and cannot be recovered.

9 Troubleshooting

In the case that infrared camera may experience problem, please carry through the following examine and repair. If the problem can't be solved, please remove the power and contact our maintenance department.

Symptom	Reason and Resolve
Can't start camera	● There is no battery in the battery compartment. →Insert a fully charged battery. ● Battery is depleted →Change the battery. ● Auto turns off to protect camera. →Restart 5 seconds later.
Camera auto turn off	● Battery is depleted →Change the battery. ● The camera may have been switched off automatically due to the settings in the Local Adapt Setup dialog box. →Press ON/OFF to switch on the camera.
Battery goes fast	● Environment temperature is too low ● Battery didn't charge completely. →Recharge the battery. ● Battery died, and is not rechargeable. →Use another battery.
No thermal image	● Forgot to remove the lens cover. →Remove the lens cover. ● Under the image frozen state. →Press 'C' button to return to the real-time image.
The thermal image turns to black and white	● Whether or nor choose the black and white palette. →Restart the camera. Switch video output between NTSC and PAL.
The measured temperature is not correct	● The distance is not right. → the best distance to the object is 2 meters. ● The measuring method is not right. → make sure the lens focus is suitable. Hold A button to adjust the lens focus. → the environment may cause the problem, wait for a few minutes to let

	the imager warming up. ● The target is too small. →get close enough to the target. ● Caused by the measuring environment →use scientific method to optimize the negative effects, the wind, dust and oxidation need to be concerned. ● The imager is too old to use. → please contact our company.

10 Appendix Material Emissivity

（Only for reference）

Material	Exterior	Status	Temperature（℃）Emissivity（ε）
Aluminum	Non-oxidation	100	0.20
	Oxygenated	100	0.55
Brass	Brown after grinding	20	0.40
	Dull luster	38	0.22
	Oxygenated	100	0.61
Copper	seriously oxygenated	20	0.78
Iron	Oxygenated	100	0.74
	Rusty	25	0.65
Cast iron	Oxygenated	200	0.64
	Non-oxygenated	100	0.21
Wrought iron	Quarry-faced	25	0.94
	Glazed	38	0.35
	Polished	38	0.28
Nickel	Non-oxygenated	200	0.37
Stainless steel	Oxygenated	60	0.85
Steel	Oxygenated in	200	0.79
Common brick	Surface	20	0.93
Concrete	Surface	20	0.92
Glass	polished plate	20	0.94
Lacquer	White	100	0.92
	Black	100	0.97
Carbon	Smoke black	25	0.95
	Candle soot	20	0.95
	Rough lead surface	20	0.98
Oil Paint	Mean value of 16 colors	100	0.94
Paper	White	20	0.93

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